

# Delay-Tolerant Radio for Cooperative Groups of Small Spacecraft, Phase I

Completed Technology Project (2018 - 2019)



## Project Introduction

Delay/Disruption Tolerant Networking (DTN) is a communication routing protocol designed specifically for high-latency applications wherein relay nodes on a multi-hop network may appear and reappear at irregular intervals. Unlike more ubiquitous TCP/IP network communications protocols that depend on known and "always on" routing paths, DTN is well suited to space-to-space applications where individual nodes in the network may be blocked or damaged. DARPA and NASA have invested significant research and even flight test demonstrations to further develop this technology.

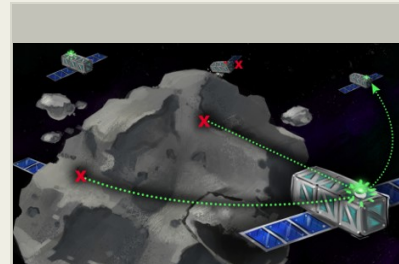
As described in this proposal, Blink Astro, LLC proposes to develop a small, affordable two-way radio transceiver that has built-in (native) hardware and software support for DTN communications protocols. Once developed and demonstrated, this new CubeSat-scale transceiver will be compatible with small satellites applications ranging from deep space swarms to commercial Low Earth Orbit (LEO) constellations.

## Anticipated Benefits

**NASA Deep-Space Swarm missions** – a small but important market given the SBIR source of funds used help fund development. Estimate periodic buys of perhaps 50 radios per mission in 2020 and beyond, averaging to 10 per year.

**DoD Geocentric Missions** – DoD missions seeking ad hoc networking for massive redundancy and communications resiliency in case of disruption. For example, DARPA's newly announced Blackjack spacecraft architecture.

**Commercial LEO Missions** – New emerging commercial space industry applications that require delay/disruption tolerant communications protocols and may have high latency. Blink's own BlinkSat™ constellation for satellite IoT is one such example.



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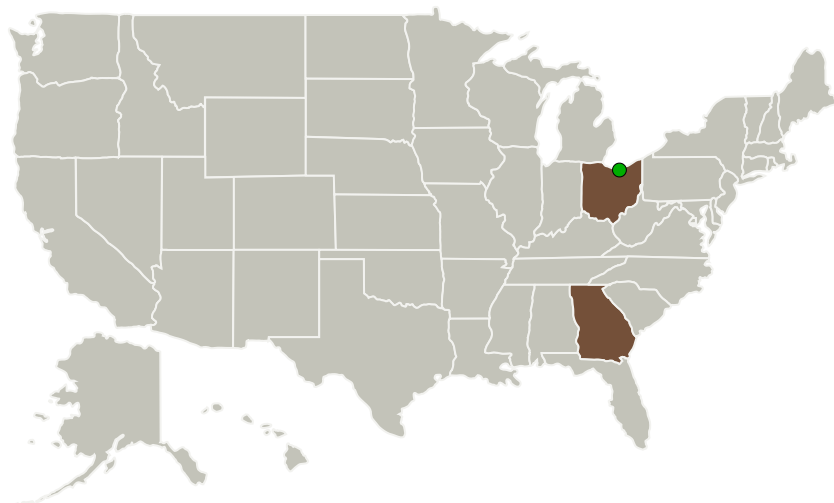
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Blink Astro, LLC	Lead Organization	Industry	Atlanta, Georgia
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

### Primary U.S. Work Locations

Georgia

Ohio

## Project Transitions

**July 2018:** Project Start**February 2019:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141326>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Blink Astro, LLC

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

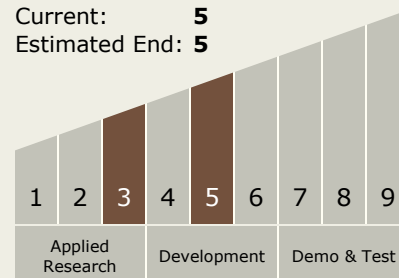
Carlos Torrez

### Principal Investigator:

Kevin Feld

## Technology Maturity (TRL)

Start: **3**  
 Current: **5**  
 Estimated End: **5**



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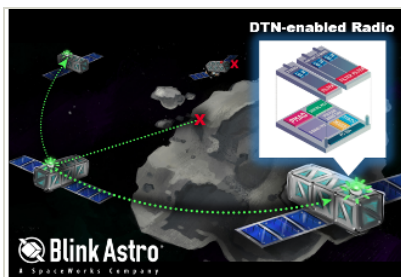
## Images



### Briefing Chart Image

Delay-Tolerant Radio for  
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(<https://techport.nasa.gov/image/134189>)



### Final Summary Chart Image

Delay-Tolerant Radio for  
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(<https://techport.nasa.gov/image/135541>)

## Technology Areas

### Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - └ TX05.3 Internetworking
    - └ TX05.3.1 Disruption Tolerant Networking

## Target Destination

Earth